इंटरनेट मानक

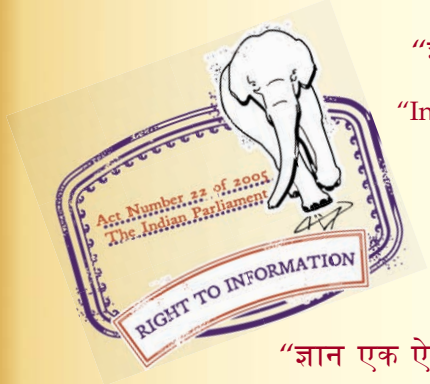
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 10242-3-25 (1987): Electrical installations in ships, Part 3: Equipment, Section 25: Shipboard telecommunication cables and radiofrequency cables: General instrumentation, control and communication cables [ETD 20: Electrical Installation]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

Electrical Equipment and Installations in Ships Sectional Committee, ETDC 62; Panel for Cables, ETDC 62/P4 [Ref : Doc : ETDC 62 (2860)]

Indian Standard (Reaffirmed 2002)

SPECIFICATION FOR ELECTRICAL INSTALLATION IN SHIPS

PART 3 EQUIPMENT

Section 25 Shipboard Telecommunication Cables and Radio-Frequency Cables: General Instrumentation, Control and Communication Cables

0. Foreword

0.1 This standard (Part 3/Sec 25) is one among the series of Indian standards on electrical installations in ships. This series will have the following parts:

Part 1 General,

Part 2 System design,

Part 3 Equipment,

Part 4 Installation and test of completed installation, and

Part 5 Special features.

0.2 In Part 3, for ease in reference, Sections 10 to 19 have been reserved for low and medium voltage power cables while Sections 20 to 29 would deal with telecommunication cables for use in ships.

0.3 This standard (Part 3/Sec 25) belongs to a series dealing with telecommunication cables and radio-frequency cables intended for the transmission of information rather than the transport of energy, and constructed specially for that purpose. Other sections in this series are as follows:

Section 23 Shipboard flexible coaxial cables,

Section 24 Telephone cables for non-essential communication services, and

Section 26 Shipboard multicore cables for control circuits.

0.4 In the preparation of this standard, assistance has been taken from the IEC Pub 92-375 (1977) 'Electrical Installations in ships: Part 375 Shipboard telecommunication cables and radio-frequency cables: General instrumentation, control and communication cables', issued by the International Electrotechnical Commission (IEC).

0.5 This part of the standard shall be read in conjunction with the other parts mentioned in **0.1**.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. Scope

1.1 This standard (Part 3/Sec 25) applies to shipboard general instrumentation, control and communication cables, intended for interconnection of all sorts of instrumentation and communication equipment including that telephone equipment whose proper functioning is thought necessary for the safety of the ship.

Adopted 16 November 1987 Gr 4

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

1.2 These cables are intended for use on systems operating up to 60 V ac or dc but will operate satisfactorily under fault conditions at voltages up to 250 V ac or dc.

1.3 This specification lays down the standard description and requirements for such cables.

Section 25A Description

2. General

2.1 Shipboard general instrumentation, control and communication cables shall consist of pairs of conductors insulated with ethylene-propylene rubber, or cross-linked polyethylene or polyvinyl chloride (PVC), laid up and provided with a taped wrapping or an inner sheath of polychloroprene or of chlorosulphonated polyethylene or of polyvinyl chloride.

2.2 The cores shall be collectively screened with a copper braid. The outer sheath shall consist of polychloroprene or of chlorosulphonated polyethylene or of polyvinyl chloride.

2.3 A cable with a triple is also specified.

2.4 For special circuits, cables with pairs of conductors insulated with silicon rubber may be specified.

Note — The user shall have to choose the right insulating material carefully because of the complex variability of the dependency on temperature and frequency of such properties as insulation resistance, dielectric constant and power factor.

This refers in particular to polyvinyl chloride.

3. Conductor

3.1 The conductor shall consist of seven strands of plain or tinned annealed copper uniform in quality and free from defects, each strand having a nominal diameter of:

a) 0·30 mm for a conductor having a nominal cross-sectional area of 0·5 mm², and

b) 0·37 mm for a conductor having a nominal cross-sectional area of 0·75 mm².

3.2 The properties of the copper shall be in accordance with IS : 9713-1981 'Hot rolled electrolytic copper wire rods for electrical conductors (*first revision*).'

3.3 The conductors shall be of tinned copper when the insulation consists of ethylene-propylene rubber compound E85 or cross-linked polyethylene compound XLPE and of plain copper with polyvinyl chloride compound PVC/C or silicone rubber compound S95.

3.4 A separation tape between the conductors and the insulation, when the latter is of ethylene-propylene rubber or cross-linked polyethylene, may be provided.

4. Insulation

4.1 The insulation shall consist of ethylene-propylene rubber compound E85, cross-linked polyethylene compound XLPE, polyvinyl chloride compound PVC/C or silicone rubber compound S95, according to IS : 10242 (Part 3/Sec 11)-1986 'Electrical installation in ships: Part 3 Equipment, Sec 11 Insulation materials for shipboard power cables'.

4.2 The minimum average thickness of the insulation shall be:

a) For cross-linked polyethylene, ethylene-propylene rubber or polyvinyl chloride:

i) 0·5 mm for a conductor having a nominal cross-sectional area of 0·5 mm², and

ii) 0·6 mm for a conductor having a nominal cross-sectional area of 0·75 mm²;

b) For silicone rubber plus glass braid:

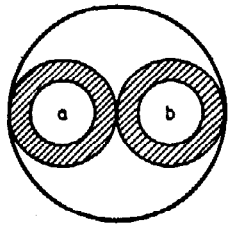
0·6 + 0·2 mm for a conductor having a nominal cross-sectional area of 0·75 mm², the braid of glass having a nominal thickness of 0·2 mm. A glass fibre tape could be used instead of braid of glass.

5. Cabling Element

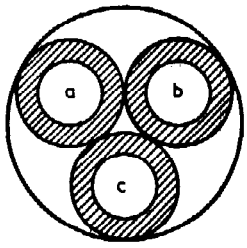
5.1 A cabling element shall be a pair of two insulated conductors, twisted together and designated wire *a* and wire *b* respectively.

5.2 In the case of a cable with a triple, the three insulated conductors shall be twisted together and designated wire *a*, wire *b* and wire *c*.

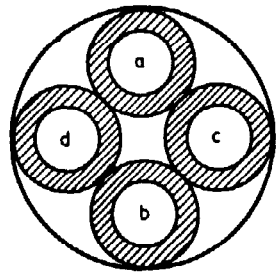
5.3 In case of a cable with two pairs, the core assembly shall consist of a quadruple four insulated conductors. twisted together and designated wire *a*, wire *b*, wire *c* and wire *d* as shown in the following diagrams:



PAIR



TRIPLE



QUAD

5.4 The maximum length of lay in the finished cable shall be 120 mm. It can be advantageous to have different lengths of lay for adjacent pairs in order to reduce cross talk and, in certain case, it may be necessary to use a shorter length of lay in order to reduce interference.

6. Cabling

6.1 All the elements shall be cabled in concentric layers.

Note — The successive layers may be separated from each other by intermediate tapes of non-hygroscopic material.

7. Total Number of Pairs

7.1 The total number of pairs shall be:

a) For pairs: 1, 2*, 4, 7, 10, 14, 19, 24, 30, 37 and 48; and

b) For triples: 1.

All pairs assembled together form the core assembly of the cable.

8. Covering of Core Assembly

8.1 In case an inner sheath is applied under the screen, the core assembly may be provided with an optional protective layer of non-hygroscopic material, for example, one or more polyester tapes.

8.2 In case no inner sheath is applied under the screen, a mandatory protective layer shall be applied over the core, consisting of at least two wrapped tapes of non-hygroscopic material (for example, polyester tapes) with a minimum total thickness of 0·1 mm.

9. Screen

9.1 A screen shall be applied over the covering in accordance with 8. It shall consist of a braid of plain or tinned copper wires. The nominal diameter of the wires in the braid shall be in accordance with Tables 1 and 2.

Note — When specifically requested in addition to collective individual pairs screening may be adopted as per the mutual agreement between the supplier and the purchaser.

9.2 One or more plain or tinned copper wires may be placed under the braid in order to facilitate connection.

9.3 Tinned copper wires shall be used when the sheath is of SP1 compound or SH1 compound, unless special precautions are taken to prevent corrosion of the plain copper wires.

10. Sheaths

10.1 The sheaths shall consist of polychloroprene compound SE1 or chlorosulphonated polyethylene compound SH 1 or polyvinyl chloride compound ST 2 according to IS : 10242 (Part 3/ Sec 11)-1986.

10.2 The outer sheath and inner sheath (when applied) shall consist of polychloroprene compound SE1 or chlorosulphonated polyethylene compound SH1 or polyvinyl chloride compound ST2 if the insulation material is ethylene-propylene rubber compound E85 or cross-linked polyethylene compound XLPE or silicone rubber compound S95. If the insulating material is polyvinyl chloride compound PVC/C, then the sheath shall consist of polyvinyl chloride compound ST2.

*As a quadruple.

10.3 A separator between the screening braid and the sheath, when the latter is of polychloroprene or chlorosulphonated polyethylene, may be applied.

TABLE 1 DIMENSIONAL DETAILS OF GENERAL INSTRUMENTATION, CONTROL AND COMMUNICATION CABLES (0·50 mm²)

(*Clauses* 9.1, 13.1 and 18.1)

Number and Composition of Conductors	Cross Sectional Area of Conductors	Minimum Average Thickness of Insulation	Minimum Average Thickness of Tape Wrapping	Nominal Diameter of Wires in Braided Screen	Minimum Average Thickness of Outer Sheath	Minimum Average Thickness of Inner Sheath	Nominal Diameter of Wire in Braided Screen	Minimum Average Thickness of Outer Sheath
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	mm²	mm	mm	mm	mm	mm	mm	mm
1 × 2/7 × 0·30	0·50	0·5	0·1	0·20	1·0	0·8	0·20	1·1
4/7 × 0·30				0·20	1·0	0·8	0·20	1·1
4 × 2/7 × 0·30				0·20	1·1	0·9	0·20	1·2
7 × 2/7 × 0·30				0·20	1·2	0·9	0·20	1·2
10 × 2/7 × 0·30				0·25	1·3	0·9	0 25	1·3
14 × 2/7 × 0·30				0·25	1·4	1·0	0·25	1·3
19 × 2/7 × 0·30				0·25	1·5	1·0	0·25	1·4
24 × 2/7 × 0·30				0·25	1·6	1·1	0·25	1·4
30 × 2/7 × 0·30				0·25	1·6	1·2	0·25	1·5
37 × 2/7 × 0·30				0·25	1·7	1·3	0·25	1·5
48 × 2/7 × 0·30				0·25	1·9	1·4	0·25	1·6
1 × 3/7 × 0·30				0·20	1·0	0·8	0·20	1·1

TABLE 2 DIMENSIONAL DETAILS OF GENERAL INSTRUMENTATION, CONTROL AND COMMUNICATION CABLES (0·75 mm²)

(*Clauses* 9.1, 13.1 and 18.1)

Number and Composition of Conductors	Cross-Sectional Area of Conductors	Minimum Average Thickness of Insulation	Minimum Average Thickness of Tape Wrapping	Nominal Diameter of Wires in Braided Screen	Minimum Average Thickness of Outer Sheath	Minimum Average Thickness of Inner Sheath	Nominal Diameter of Wires in Braided Screen	Minimum Average Thickness of Outer Sheath
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	mm²	mm	mm	mm	mm	mm	mm	mm
1 × 2/7 × 0 37	0·75	0·6	0·1	0·20	1·0	0·8	0·20	1·1
4/7 × 0·37				0·20	1·1	0·8	0·20	1·1
4 × 2/7 × 0·37				0·20	1·2	0·9	0·20	1·2
7 × 2/7 × 0·37				0·20	1·3	0·9	0·20	1·3
10 × 2/7 × 0·37				0·20	1·4	1·0	0·20	1·3
14 × 2/7 × 0·37				0·25	1·5	1·1	0·25	1·4
19 × 2/7 × 0·37				0·25	1·6	1·1	0·25	1·5
24 × 2/7 × 0·37				0·25	1·7	1·3	0·25	1·5
30 × 2/7 × 0·37				0·25	1·8	1-3	0·25	1·6
37 × 2/7 × 0·37				0·30	1·9	1·3	0·30	1·7
48 × 2/7 × 0·37				0·30	2·1	1·4	0·30	1·8
1 × 3/7 × 0·37	0·75	0·6	0·1	0·20	1·0	0·8	0·20	1·1

Sheath thicknesses specified in this table are also applicable to silicone rubber insulated cables.

Section 25B Requirements

11. Conductor

11.1 The conductors shall be of the category 'circular non-compacted conductor' according to IS : 8130-1984 'Conductors for insulated electric cables and flexible cords (*first revision*)' and their nominal cross-sectional area shall be of 0·5 or 0·75 mm^2.

11.2 Elongation at break of the strands of the conductors shall be at least 15 percent. Compliance shall be checked by measuring the elongation at break in accordance with IS : 5608 (Part 1)-1970 'Low frequency wires and cables with PVC insulation and PVC sheath: Part 1 General requirements and tests'.

11.3 Tinned copper conductors shall comply with the solder test defined in IS : 5608 (Part I)-1970.

12. Insulating Material

12.1 The insulating compounds E85, XLPE, PVC/C and S95 shall comply with the relevant provisions of IS.: 10242 (Part 3/Sec 11)-1986.

13. Insulation Thickness

13.1 The insulation shall be continuous and of a thickness as uniform as possible. The minimum thickness shall be measured in accordance with IS : 5608 (Part 1)-1970. The minimum average thickness shall be not less than that specified in Tables 1 and 2. The smallest of the measured values shall not fall below the specified minimum average insulation thickness by more than 0·10 mm + 10 percent of the specified thickness.

14. Identification of Insulated Conductors (Cores)

14.1 Identification of insulated conductors (cores) shall be made, at the manufacturer's choice, according to one of the two methods given below:

14.1.1 *Method 1*: *Printed numbers* — Identification by numbers of each core starting from the centre; cores of the same pair, triple or quad shall bear successive numbers. Identification shall be made by inscription of numbers in accordance with the following:

a) *Description* — The inscription is composed of marks repeated at regular intervals all along the core.

Each mark comprises of:

i) a reference number between 1 and 48 in Arabic numerals, beginning always with 1; and

ii) a dash which underlines this reference number and indicates the direction in which the number should be read.

b) *Arrangement of the marks* — Two consecutive marks shall always be placed upside down in relation to one another. The arrangement of the marks is shown in Fig. 1.

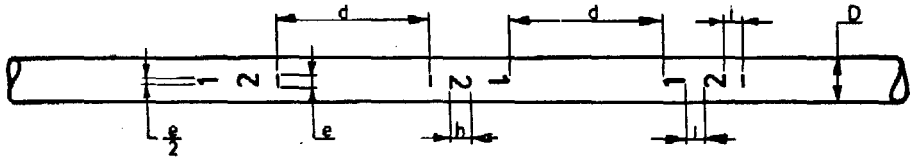


FIG. 1 ARRANGEMENTS OF THE MARKS

When the reference consists of a single numeral, the dash is placed under it; if the reference number consists of two numerals, these are disposed one below the other and the dash is placed underneath the lower numeral.

c) *Spacing and dimensions of the marks* — The dimensions of the marks and the spacing are given in the following table, where:

e = minimum width of a mark;

h = minimum height of a numeral;

i = approximate interval, in a mark, between two consecutive numerals as well as between numeral and dash; and

d = maximum interval between two consecutive marks.

Nominal Diameter, D of the Core mm	*e** mm	*h* mm	*i* mm	*d* mm
$D < 2{\cdot}4$	0·6	2·3	2	50
$2{\cdot}4 \leqslant D \leqslant 5$	1·2	3·2	3	50

d) *Appearance of inscription* — The inscription shall be legible and of a colour which contrasts with that of the core. All the marks of the cores of a particular cable shall have the same colour.

14.1.2 *Method 2: Colour code* — Identification of pairs, triples or quades shall be by tapes marked with numbers. Cabling elements shall be identified by means of the following colour code:

Cabling Element	*Wire a*	*Wire b*	*Wire c*	*Wire d*
Pair	Black	Light blue	—	—
Triple	Black	Light blue	Brown	—
Quad	Black	Brown	Light blue	Grey

For cables having four or more pairs, the pairs shall be identified from each other by means of polyester tapes marked with numbers.

15. Stripping Properties of Insulation

15.1 It shall be possible to strip the insulation from the conductor easily and without damage to the insulation or to the conductor. Compliance shall be checked by measuring the force necessary to start the sliding of the insulation in accordance with IS : 5608 (Part 1)-1970.

The value of the force is under consideration.

16. Screen

16.1 The screen shall consist of a symmetrical braid of plain or tinned copper wires. Joints in the braiding wires shall be soldered, twisted or woven-in and there shall be no joint in the complete braid. The braid shall be evenly applied.

The filling factor as specified in IS : 5026-1969 'General requirements and tests for radio frequency cables, shall be at least 0·6.

17. Sheath Material

17.1 The compounds of the sheaths SP1 or SH1 or SV2 shall comply with the relevant provisions of IS : 10242 (Part 3/Sec 11)-1986.

18. Sheath Thickness

18.1 The sheaths shall be continuous and of a thickness as uniform as possible. The minimum average thickness shall be not less than that specified in Table 1 and 2.

18.2 The minimum thickness shall not fall below the specified mean thickness by more than 0·10 mm + 15 percent of the specified thickness. Both the minimum average thickness and minimum thickness of the sheaths shall be measured according to IS : 5608 (Part 1)-1970.

19. Cable Marking

19.1 The cables shall be provided with an identification of the manufacturer and the year of manufacture.

Other markings are under consideration.

20. Flame Retardance

20.1 The finished cable shall not transmit or assist flames. Compliance shall be checked in accordance with the tests specified in IS : 10810 (Part 53)-1984 'Methods of test for cables : Part 53 Flammability test'.

Note — Further parts under IS : 10810 covering methods of test for checking various characteristics for flame retardant properties of the cables are under preparation. Reference to these will, therefore, be added in due course. Till such time the relevant Indian Standards are available, the flame retardant characteristics of the cables may be checked in accordance with IEC Pub 331 (1970) 'Fire-resisting characteristics of electric cables, and IEC Pub 332 (1970) 'Tests on electric cables under fire conditions.'

*When the numeral is 1, the minimum width is equal to half the dimension given in this table.

Section 25C Electrical Properties of Finished Cables

21. Electrical Resistance of Conductors

21.1 The resistance of each conductor shall not exceed the following values calculated according to IS : 9941-1981 'Guide to calculation of resistance of plain and tinned copper conductors of low frequency cables and wires'.

Nominal Cross-Sectional Area	*Tinned Conductors*	*Untinned (Plain) Conductors*
mm²	Ω/km at 20°C	Ω/km at 20°C
0·5	41·6	40·6
0·75	26·6	26·0

The method for measurement of resistance and also for correction of the measured values for length and temperature is described in IS : 5608 (Part 1) - 1970.

22. Dielectric Strength

22.1 This test shall be carried out as specified in IS : 5608 (Part 1)-1970.

The value of the test voltage shall be 1 500 V ac or 3 000 V dc. The test shall be carried out on complete lengths of the finished cable. The full voltage shall be maintained for 5 min.

23. Insulation Resistance

23.1 The insulation reistance at a temperature of 20°C shall be not less than the values specified in Table 3. The method for measurement of insulation resistance is described in IS : 5608 (Part 1) - 1970.

TABLE 3 INSULATION RESISTANCE OF GENERAL INSTRUMENTATION, CONTROL AND COMMUNICATION CABLES

Conductor	Conductor Area	Insulation Material	K_1	Minimum Average Thickness of Insulation	Minimum Insulation Resistance at 20°C
(1)	(2)	(3)	(4)	(5)	(6)
mm	mm²		MΩkm	mm	MΩkm
7 × 0·30	0·50	Polyvinyl chloride (PVC/C)	750	0·5	245
		Ethylenepropylene rubber (E85)	3 670	0·5	1 170
		Cross-linked polyethylene (XLPE)	*	0·5	*
7 × 0·37	0·75	Polyvinyl chloride (PVC/C)	750	0·6	240
		Ethylenepropylene rubber (E85)	3 670	0·6	1 145
		Cross-linked polyethylene (XLPE)	*	0·6	*
		Silicone rubber glass braid (S95)	1 500†	0·6 + 0·2	480†

*Under consideration.
†Values under revision.

24. Mutual Capacitance

24.1 Measurement of mutual capacitance is optional. The measurement, if any, shall be carried out in accordance with IS : 5608 (Part 1)-1970.

The measured mutual capacitance of any pair of conductors shall not exceed the following provisional (*to be revised after due experience*) values:

a) For compounds E85, XLPE, 595 : 120 nF/km;

b) For compoud PVC/C: 200 nF/km.

25. Capacitance Unbalance

25.1 The measurement shall be carried out in accordance with IS : 5608 (Part 1)-1970.

The measured capacitance unbalance between any pair of conductors shall not exceed 1 000 pF for 500 m length of cable.

Printed at New India Printing Press, Khurja, India